

## Effect of Cooking Time on Physical Properties of Almond Milk-Based *Lemak Cili Api* Gravy

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**Abstract:** One of the crucial elements in developing or reformulating product is to maintain the quality throughout its entire shelf life. This study aims to determine the effect of different cooking time on the almond milk-based of *lemak cili api* gravy. Various cooking times of 5, 10, 15, 20, 25 and 30 minutes were employed to the almond milk-based *lemak cili api* gravy followed by determination of their effects on physical properties such as total soluble solids content, pH and colour. pH was determined by using a pH meter. Refractometer was used to evaluate the total soluble solids content of almond milk-based *lemak cili api* gravy. The colours were determined by using spectrophotometer which expressed as  $L^*$ ,  $a^*$  and  $b^*$  values. Results showed that almond milk-based *lemak cili api* gravy has constant values of total soluble solids with pH range of 5 to 6, which can be classified as low acid food. Colour analysis showed that the lightness ( $L^*$ ) and yellowness ( $b^*$ ) are significantly increased while redness ( $a^*$ ) decreased. In conclusion, this study shows that physical properties of almond milk-based *lemak cili api* gravy changes by increasing the cooking time.

**Keyword:** Colour; *lemak cili api*; gravy; paste; pH; total soluble solids.

### 1. Introduction

*Lemak cili api* is a hot and spicy delicacy that is popular in Negeri Sembilan [1]. It comprises of three main ingredients which are turmeric, coconut milk and bird's eye chillies [2]. Combination of other ingredients such as onions, lemongrass, and other spices makes a perfect blend of fresh concoction that is balanced with salt and sugar [3]. Although it may consist of different variation and styles due to different preference in food, most Malay traditional cuisine is believed to have same similarities in term of characteristics of the food which are strong, spicy and aromatic. Commonly, *lemak cili api* is prepared from onion, garlic, lemon grass, bird's eye chillies, ginger, and additive such as salt and sugar by blending them all together to obtain a homogenous green-yellow paste that provide colour, spicy taste and authentic fragrant dish. Physical and chemical properties changes in food components that are caused by temperature changes and closely related to the quality of food and acceptance of consumer. Thus, it turns into desired qualities as the product builds. Food quality on products is important for consumer requirements, defined

in term of physical properties such as appearance and colour which influence the standard acceptance range and qualities for food to assure quality control and assurance of food. Variations of processing such as cooking, storage, and evaporation will influence the overall properties of the final product in terms of taste, colour, and texture [4]. The changes of colour, pH and total soluble solids of *lemak cili api* gravy after being cooked could be related with people in different ways due to the influences of scents and colours that create feeling to increase purchase probability that helps with consumer preference [5]. Owing this information, this study aims to investigate the effect of cooking time on the physical properties of almond milk-based *lemak cili api* gravy representing the quality of food and commercialising traditional food.

### 2. Materials and Methods

#### Ingredients preparation

Cane sugar (Gula Prai, MSM Malaysia Holding Berhad), salt (STC fine salt, STC SUPERB Sdn. Bnd) and Malabar tamarind (Asam Jawa Penguin, Kim Loong Huat

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Industries Sdn. Bhd) were purchased from a local supermarket (Wellward, in Batu Pahat, Malaysia). The remaining ingredients used like onion, garlic, turmeric, lemon grass, ginger, birds's eye chillies and almond were bought fresh to maintain the quality.

Almond milk used as substitute for coconut milk was extracted by blending the whole almond nuts with tap water. All fresh ingredients such as onion, garlic, ginger, turmeric, lemon grass and birds's eye chillies were sorted, peeled, trimmed, washed and weighed according to the recipe in Table 1.

### **Lemak cili api paste and gravy preparation**

*Lemak cili api* paste were prepared based on an original recipe [6] with some modification to reduce the fat source. The compositions of *lemak cili api* paste are given in Table 1. Fresh ingredients such as onion, garlic, lemon grass, and ginger were peeled and homogenised in order to make a 202 g of mixture using a knife mill (HR7628/00, Philips, Jakarta).

*Lemak cili api* gravy was cooked by using a controlled temperature crepe maker machine (JB35-2, Star Choice, Russia) and initial temperature were set at 70 °C for 5 minutes to simmer the paste then increase to 140 °C as the remaining ingredients which are almond milk, salt, sugar, tamarind, and water as well as *lemak cili api* paste were added. Physical properties of *lemak cili api* gravy were determined at a 5 minute interval for 30 minutes.

### **Physical properties determination**

The pH value of 10 ml of homogenised almond milk-based *lemak cili api* gravy was measured by using a pH meter (Eutech, PH700, USA), which was calibrated with standard buffers of pH 4.0, pH 7.0, pH 10.0 before the measurement [7].

Total soluble solids (TSS) content of almond milk-based *lemak cili api* gravy was measured by using a refractometer (PAL-BX/RI, ATAGO, Japan), which was calibrated by using distilled water. The surface of lens was washed with distilled water and dried with paper towel to remove excess water then tested with *lemak cili api* gravy [8].

The colours of cooked gravy of almond milk-based *lemak cili api* were determined by using spectrophotometer (MiniScanE2, Hunter lab, USA). Cleaned petri dish containing the

almond milk-based *lemak cili api* gravy was placed below the light source and post-processing  $L$ ,  $a$  and  $b$  values were recorded [9]. The colour was expressed in CIE Lab system  $L^*$ ,  $a^*$ , and  $b^*$  values, where  $L^*$  indicate lightness on a 0-100 scale from black to white,  $a^*$  red (+) and green (-), and  $b^*$  yellow (+) and blue (-).

The volume of almond milk-based *lemak cili api* gravy was measured by using measuring cylinder. Almond milk-based *lemak cili api* gravy were measured for initial value at a 5 minutes interval for 30 minutes.

**Table 1** Formulation of almond milk-based *lemak cili api* paste using selected spices.

No	Ingredient	Percentage (%)
1	Onion	11.08
2	Garlic	2.77
3	Turmeric	0.55
4	Lemon grass	2.22
5	Bird's eye chillies	2.77
6	Malabar tamarind	0.67
7	Salt	1.11
8	Sugar	0.11
9	Ginger	1.11
10	Almond milk	22.17
11	Water	55.43
	Total	100.00

### **3. Results and Discussion**

The changes in pH of almond milk-based *lemak cili api* gravy during 30 minutes cooking time are shown in Table 2. Initial value of samples at 5 minutes was 6.13 which decreased to 5.96 at the end of 30 minutes of cooking time. This could be the results of loss of chlorophyll of certain ingredients due to heating process that affect its stability [10]. In addition, the degradation of bioactive compounds in vegetables may occur during cooking process, causing change in physical characteristics and chemical composition [11]. The reduction of volume affected by evaporation process during cooking time may also contribute to the changes of the samples (Table 2). When comparing the pH value, it constantly decreases at 5, 10 and 25 minutes of cooking time, the content of pH value were significant ( $p < 0.05$ ) at 5, 25 and 30 minutes of cooking time. This shows that almond milk-based *lemak cili api* is classified as a low acid

canned food due to its pH of 5-6 and water activity greater than 0.85 [12].

Table 2 also shows the changes in TSS content. Approximately 7.25-8.05% of TSS changes had showed at 5 to 30 minutes of cooking time. However, the changes of TSS were slightly increased at minute 10 (7.25%) and 15 (8.05%) during the process. This result showed similar finding by Khan (2007) which has studied on the heat treatment process of the orange fruit for 15 minutes at 50 °C. The study had shown that the heat treatment slows down the ripening process and delaying soluble solid increment [13]. The same study had also determined that the amount of TSS gradually increased during storage for 60 days (8.66%). TSS corresponds with temperature applied on food is based on a study by Kurca [14] on black carrot. The anthocyanin properties that are highly reactive causes increase in solid content during heating as reacting molecules become closer when the product is concentrated [15].

Colour evaluation on the almond milk-based *lemak cili api* gravy was done as the heat treatment with temperature more than 60 °C causes pigment destruction that is expressed in term of colour parameter  $L^*$ ,  $a^*$  and  $b^*$  values [16].  $L^*$  value for gravy shows a high scale in lightness which ranging from 61.18-55.41 for 30 minutes of cooking duration. Meanwhile, for  $a^*$  (green) and  $b^*$  (yellowness) values, it shows  $a^*$  have higher negative value (green) (-6.06 until -4.42) as for  $b^*$  value have higher positive value (yellowness) ranging from 37.44 to 42.32, respectively. The main colorant affect in almond milk-based *lemak cili api* gravy was due to the incorporation of turmeric (curcumin) that gives yellow colour to the gravy as well as due to acid that neutralises the pH value range [17]. A study by Weeranakorn [18] on fortification of calcium on green curry as an alternative source of calcium on traditional food shows a change in  $L^*$  value compared to control with higher  $b^*$  value which gives it greenish-yellow colour.

**Table 2** Physical properties of almond milk-based *lemak cili api* gravy over cooking time.

Time (min)	pH	TSS (%)	Colour			Volume (ml)
			L	a	b	
5	6.13 ± 0.007 <sup>a</sup>	7.25 ± 0.071 <sup>c</sup>	61.18 ± 0.28 <sup>a</sup>	-6.06 ± 0.33 <sup>c</sup>	38.17 ± 2.63 <sup>ab</sup>	990
10	6.03 ± 0.021 <sup>bc</sup>	7.25 ± 0.071 <sup>c</sup>	57.19 ± 0.55 <sup>b</sup>	-5.44 ± 0.06 <sup>b</sup>	42.32 ± 4.53 <sup>a</sup>	970
15	6.07 ± 0.049 <sup>ab</sup>	8.05 ± 0.071 <sup>ab</sup>	55.69 ± 1.08 <sup>bc</sup>	-4.55 ± 0.21 <sup>a</sup>	38.42 ± 0.07 <sup>ab</sup>	950
20	6.04 ± 0.021 <sup>bc</sup>	8.20 ± 0.280 <sup>a</sup>	54.26 ± 0.078 <sup>c</sup>	-4.59 ± 0.13 <sup>a</sup>	35.29 ± 1.53 <sup>b</sup>	890
25	5.92 ± 0.021 <sup>d</sup>	7.70 ± 0.140 <sup>b</sup>	55.53 ± 0.21 <sup>bc</sup>	-5.42 ± 0.05 <sup>b</sup>	37.96 ± 0.58 <sup>ab</sup>	840
30	5.96 ± 0.057 <sup>cd</sup>	7.85 ± 0.210 <sup>ab</sup>	55.41 ± 1.62 <sup>bc</sup>	-4.42 ± 0.14 <sup>a</sup>	37.44 ± 1.75 <sup>ab</sup>	820

Different letters in same column means the value are significantly different ( $p < 0.05$ ), the mean of a is higher than b and c ( $a > b > c$ ).

#### 4. Conclusion

Cooking time has significant effects on pH, TSS and colour of almond milk-based *lemak cili api* gravy. TSS value increased slightly over cooking time. Heat may increase the  $L^*$  value of *lemak cili api* gravy due to the degradation of colour of ingredients such as turmeric and bird's eye chillies. This study leads to the investigation of factors that may affect the quality of food due to cooking process.

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